BLOCKERS AND FINDERS

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BLOCKERS AND FINDERS

INTRODUCTION

BLOCKERS AND FINDERS was suggested by Baffles, the creation of *James D. Spain*, which (in turn) was suggested by Black Box, an old and classic public domain program.

Baffles, about which I have written widely, was created for university-level seniors –in particular, Pre-Med students. Its main objective is to develop the abilities needed for medical diagnosis. In this game, students use probes to locate hidden barriers, called baffles, which change the course of the probes' paths. What's involved here is several-fold: the selecting of data in complex conditions, the organizing of those data, the generation and testing of hypotheses, and the making of judgments.

BLOCKERS AND FINDERS, like Baffles, has inference as its central focus. But inference, the deriving of information from other information, is not merely at the heart of medical diagnosis. It is at the heart of all intellectual inquiry. Yet, despite its importance in scientific and intellectual disciplines, inference receives very little attention in our school curriculum.

The idea for *BLOCKERS AND FINDERS* came to me as I tested the original Baffles with fifth and sixth graders. As I watched young children become engrossed in the problems and mysteries of the game (to the point that they refused to go out on recess), I became convinced of the need to create a program similar to Baffles, but one which might be accessible to younger children, even children as young as 5 or 6.

The first step was to create a context. Instead of probes and Baffles, we would have Finders (engaging animals which are sent on paths) and Blockers (which alter those paths). And the game would start at 1 Tilty instead of the original 5 Baffles, thus allowing play for very young children. Furthermore, a wide variety of entry points would be allowed to give the learner as much control as possible. Thus *BLOCKERS AND FINDERS* would allow, at its Junior Level, the selection of 1, 2, 3, or 4 Tilties. Since good software tends to appeal to a wide age-range, an Intermediate Level (5-8 Tillties) and a Senior Level (9-12 Tilties) were added. The program could then challenge even the brightest adult.

But the story doesn't end there. Other search games were added. Students would play not only with Tilties, but with Arrows and Detours. As with Tilties, Arrows and Detours would have a Junior (1-4 Arrows or Detours), Intermediate (5-8 Arrows or Detours), and Senior (9-12 Arrows or Detours) Level.

In this manner, *BLOCKERS AND FINDERS* became a complex program offering three challenges for players from first grade through adult. The problems can be quite challenging. If you, as an adult, get slowed down at 5 Tilties or 5 Arrows or 5 Detours, don't feel bad. The issue is very, very complex. But watch kids as they seek ever higher challenges.

In summary, *BLOCKERS AND FINDERS* has problem solving and inference as its main focus, and the problems involved range from the very simple to very, very complex.

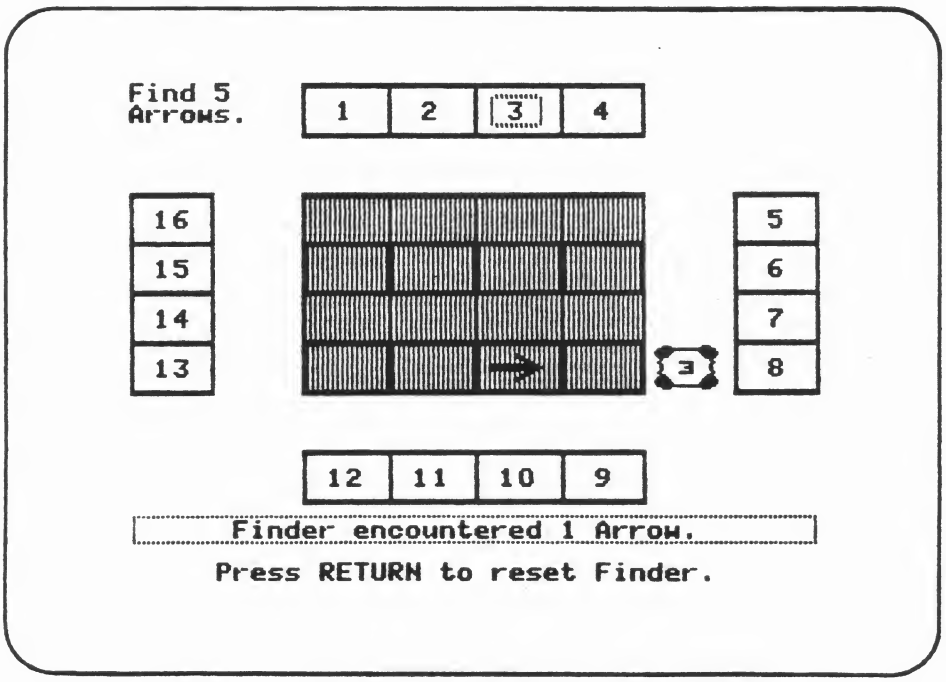
What does problem solving involve? Hofstadter says it nicely in his book "Godel, Escher, Bach":

- to respond to situations flexibly;
- to take advantages of fortuitous circumstances;
- to make sense of ambiguous or contradictory messages;
- to recognize the importance of different elements of a situation;
- to find similarities between situations despite differences that may separate them;
- to synthesize new concepts by taking old concepts and putting them together in new ways; and to come up with novel ideas.

BLOCKERS AND FINDERS, then, is concerned with problem solving in the Hofstadter sense of the word. It is concerned with children's ability--and willingness and confidence--to make sense out of a situation. It is also concerned with children's ability to devise alternatives in order to reach a goal. The construction of alternatives, not the repetition of pat formulas, is what thinking and problem solving are all about.

BLOCKERS AND FINDERS

PROGRAM OBJECTIVES



Skills: Selection and coordination of data
Formation of hypotheses
Hypothesis testing
Inference

Grade Level: 1 - adult

Time Required: 5 - 30 minutes

Objectives:

1. to develop critical-thinking abilities.
2. to develop problem-solving abilities.
3. to develop students' confidence in their own original thinking.
4. to develop students' inference abilities in an area involving mystery, challenge, and complexity.
5. to develop students' ability to deal with ambiguity.

BLOCKERS AND FINDERS

PROGRAM OVERVIEW

BLOCKERS AND FINDERS consists of three search games: Tilties, Arrows, and Detours. These are obstacles, or "Blockers" hidden on a four by four grid.

Blockers divert the path of little creatures called Finders, which are sent through the grid by the students. The task is to locate the Blockers by guessing the Finder's path. Their path is hidden, but the starting and destination points are visible. Students can send as many Finders as they wish until they have collected enough data to determine the location of the Blockers. These data are derived from the starting and destination points of each Finder, as well as from a feedback message indicating the number of Blockers encountered by each Finder.

Students form a hypothesis as to the location of Blockers. Using a special option, they place tentative Blockers on the grid. They can then compare their solution with the computer solution.

Within each game, students can choose from three broad levels of play: Junior, Intermediate, and Senior. Within each of these broad levels, students can also choose four levels of play as follows:

Junior Level: 1, 2, 3, or 4 Blockers
Intermediate Level: 5, 6, 7, or 8 Blockers
Senior Level: 9, 10, 11, or 12 Blockers

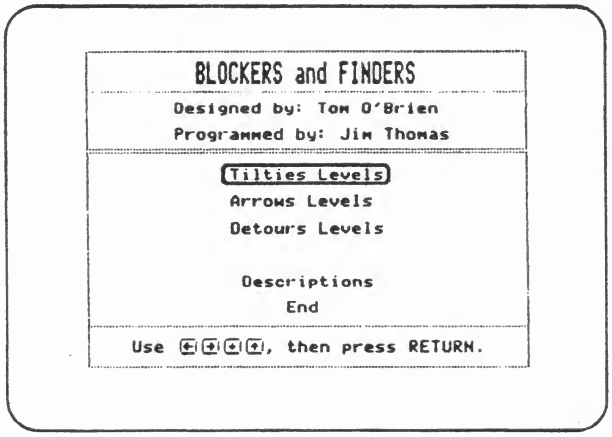
At the lower levels, the problems are relatively easy. At the higher levels, ambiguities can arise and their solution requires the collection, coordination, and evaluation of very complex information. In some cases there are several solutions and students may come up with an acceptable solution that is different from the computer's solution. For this reason, *BLOCKERS AND FINDERS* was designed to test the students' arrangements of Blockers for consistency. If the students' solution is consistent with the game but different from the computer version, students are told that their solution is correct. They are then given the opportunity of finding the computer's solution.

The Change Options allow teachers to control certain elements in the program by turning the sound on or off, and by choosing whether students will be given a message indicating the number of Blockers encountered by each Finder.

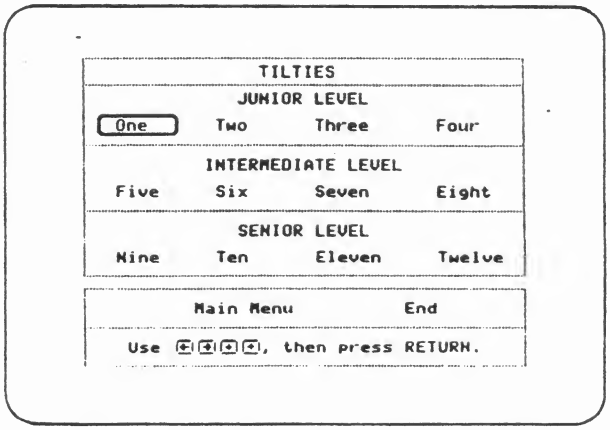
PROGRAM DESCRIPTION

STARTING THE PROGRAM

BLOCKERS AND FINDERS **offers 3 activities: Tilties, Arrows, and Detours. After the opening screen, students first select a type of Blocker from the main menu as shown below:**



Within each activity, students can choose 3 broad levels of play, and they select up to 12 Blockers (in this case Tilties), as shown below:

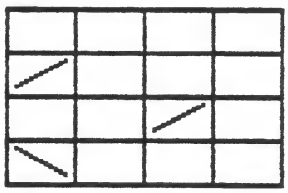


BLOCKERS

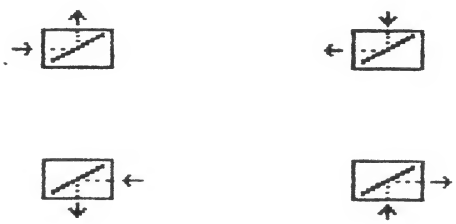
There are 3 types of Blockers: Tilties, Arrows, and Detours. Each of these Blockers divert the Finders' paths in a different manner.

Tilties

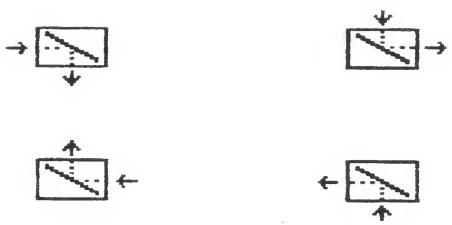
Tilties may look like this on the grid:



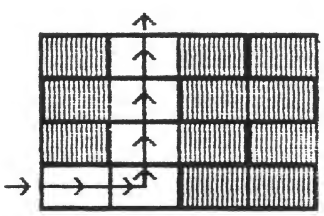
When a Finder hits a Tilty, it goes like one of these:



or one of these:



Here is a path followed by a Finder with only one Tilty hidden:

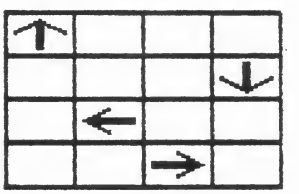


Can you tell where the Tilty is hidden? Can you tell whether it appears like this **or like this** **?**

BLOCKERS AND FINDERS

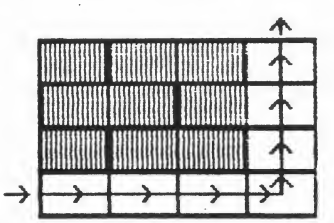
Arrows

Arrows may look like this on a grid:



When a Finder encounters an Arrow, it must follow the direction of the Arrow, as shown below:

Here is a path followed by a Finder with only one Arrow hidden:

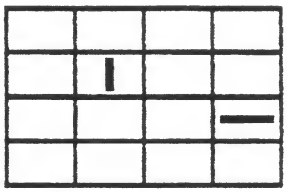


Can you find where the Arrow is hidden? Which way does it point?

BLOCKERS AND FINDERS

Detours

Detours may look like this on the grid:

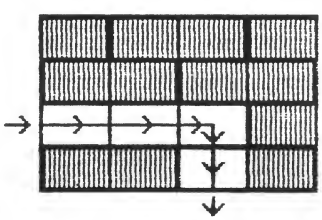


A Finder can encounter 4 types of Detours when perpendicular to the Blocker:

A Finder can also pass through a Detour as follows:

During a single game, students will encounter only one type of Detour, and one type of Detour, for example:

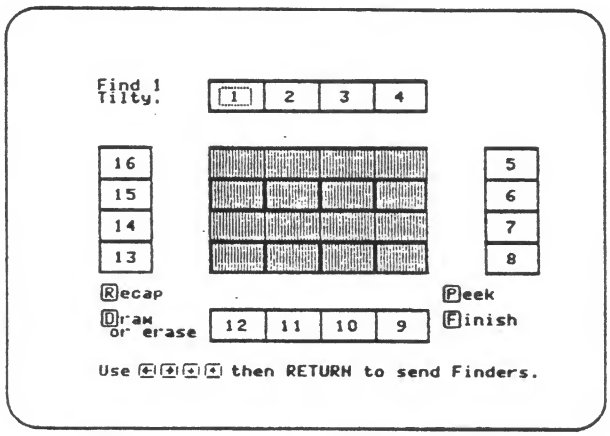
Here is a path followed by a Finder with only one Detour hidden:



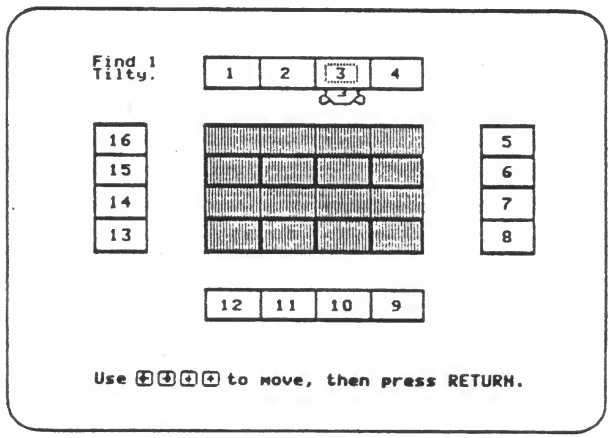
Can you find the Detour? Is it like this or like this ?

FINDERS

In order to find the hidden Blockers, students send Finders through the grid. Numbers representing each of the 16 Finders' starting positions are displayed around the grid as shown below:



To select a Finder, students move the box to the desired number using the ← → ↓ ↑ keys. (On the Apple II+, the ← → keys move the box counterclockwise and clockwise.) Pressing RETURN will send the Finder on a trip as shown below:

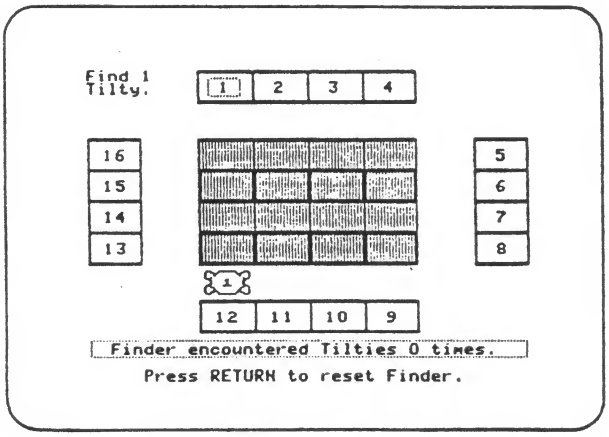


The Finder will then travel through the grid on a hidden path before coming out of the grid. A message will also be displayed indicating the number of Blockers encountered by the Finder.

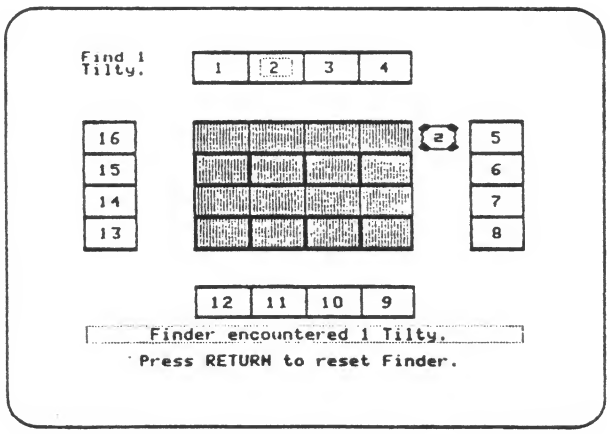
<u>Note:</u> The game can be played without this message. Through the Change Options (page 24), teachers can choose whether or not the students will be shown the message.

Finders and Tilties

Suppose students send Finder 1 in a one-Tilty game, as in the example shown below:



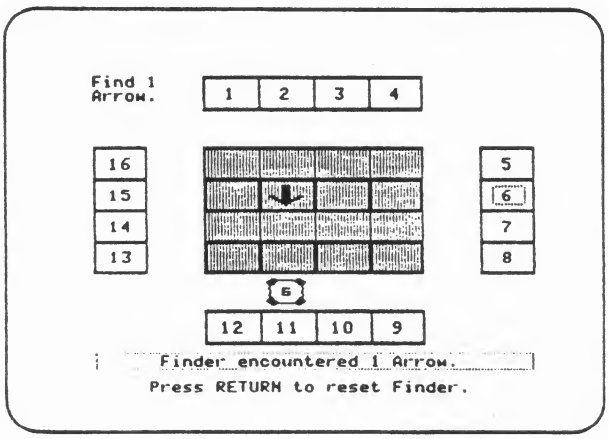
Finder 1 seems to have passed right through the grid on a straight path. This assumption is reinforced by a message displayed at the end of the Finder's trip . The message indicates the number of Tilties encountered by the Finder: in this case, no Tilties were encountered. But suppose Finder 2 is sent through the grid. The result may be as follows:



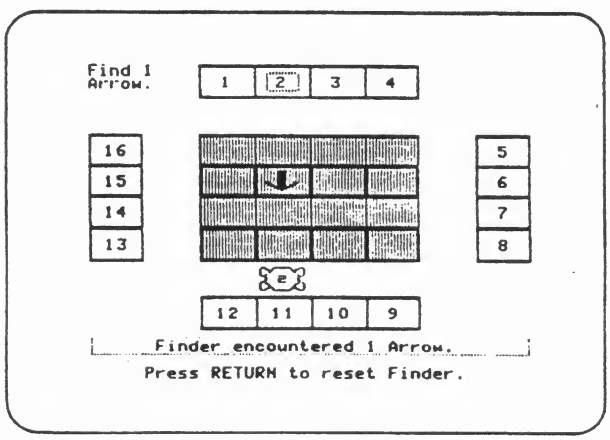
One tilty has been encountered. It should be located at the place where Finder 2 changed its course. Which Tilty is it: or ?

Finders and Arrows

Suppose Finder 6 encounters an Arrow in a one-Arrow game. The change of direction in the Finder's path is enough to indicate the Arrow's location and direction, as shown below:

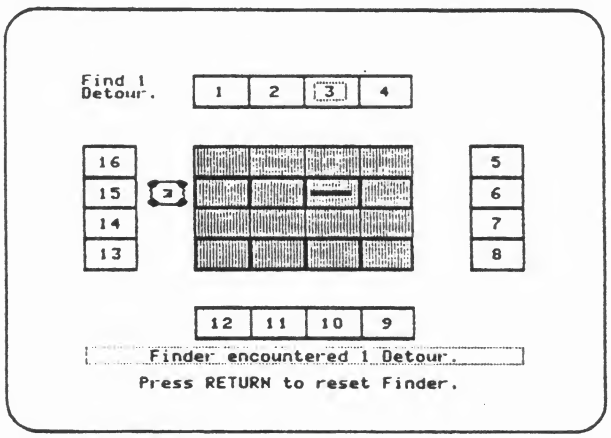


But suppose the Arrow points toward the Finder's destination, as in the example below. In this case, Finder 2 ends up at location 11. The Finder has not been diverted, but the message is still as follows:

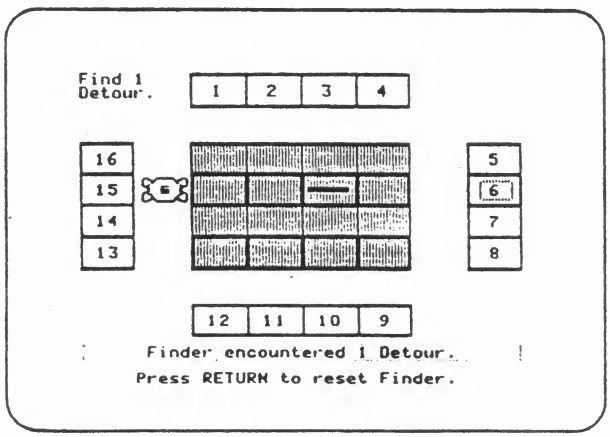


Finders and Detours

As with Tilties and Arrows, a Finder can be diverted by Detours. In a one-Detour game, the change of direction in the Finder's path is enough to indicate the location and direction of the Detour:



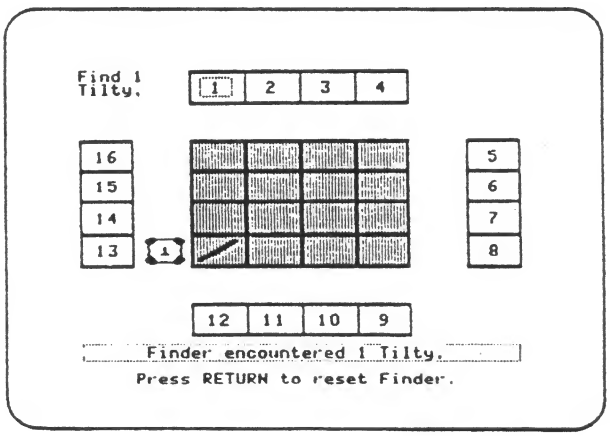
As with Arrows, Detours can also lie in a Finder's path, and the Finder will continue in the same direction without being diverted:



PLAYING THE GAME

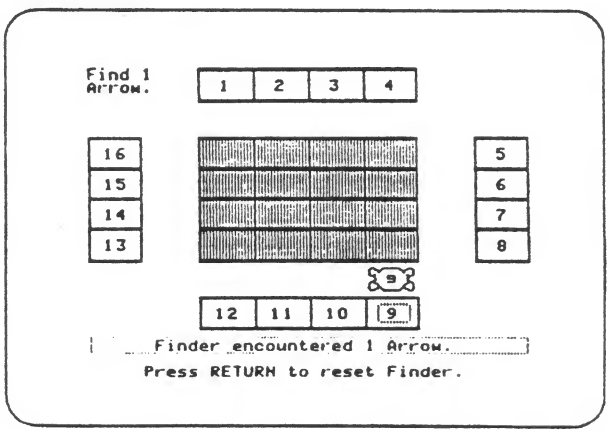
One-Tilty Game

Here are examples of the complexity involved in each activity. In a one-Tilty game, the information displayed is sufficient to find the solution. If a Finder encounters one Tilty, the location and orientation (or) of the Tilty is apparent, as shown below:

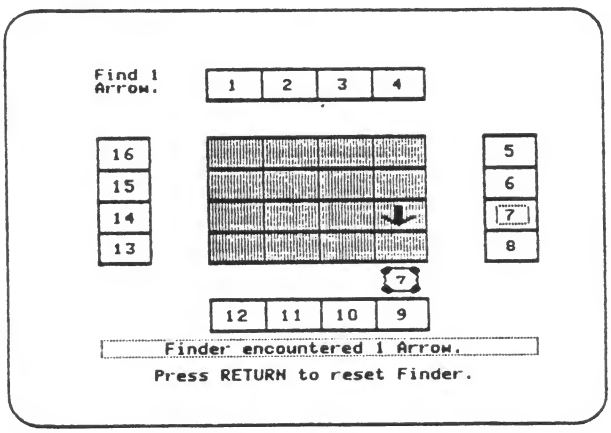


One-Arrow Game

In a one-Arrow game, however, the situation can be more complex. In the example shown below, the message displayed indicates that one Arrow was hit, but all we know is that the Arrow lies along the path of Finder 9. We also know that the Arrow points toward the Finder's starting position:

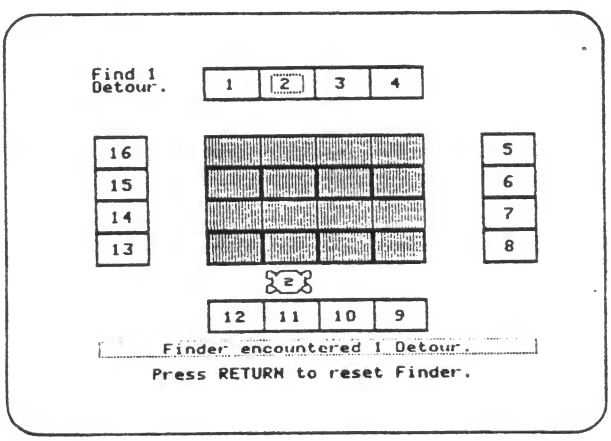


To know the Arrow's location, further investigation is required. Sending Finders perpendicular to the path of Finder 9 will provide additional information. In this case, sending Finder 7 will locate the Arrow:



One-Detour Game

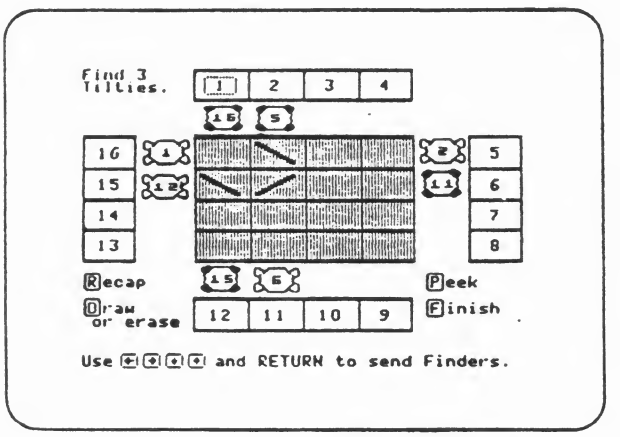
The same situation in a Detour game is just as complex. In the example shown below, the message indicates that one Detour was hit, but all we know is that the Detour lies along the path of Finder 2.

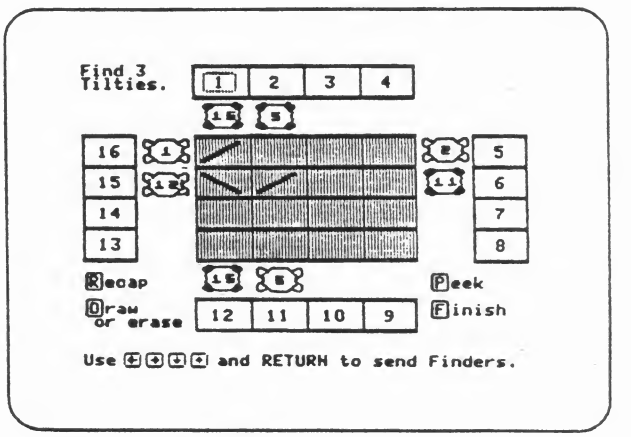


To find the Detour's location, further investigation is required. In this case, sending Finders perpendicular to the path of Finder 2 will locate the Detour.

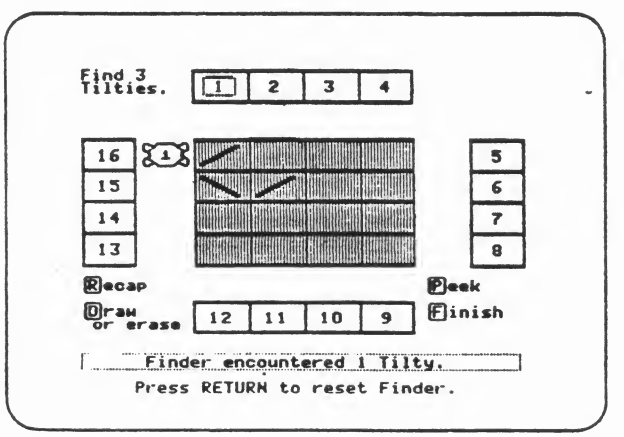
AMBIGUITIES

Even with as few as 3 Blockers (3 Tilties, 3 Arrows, or 3 Detours), students may encounter situations involving multiple solutions. In the three-Tilties game shown below, two solutions are displayed. In both solutions, the layout of the Tilties is consistent with the destination of the Finders. At this point, both solutions are acceptable unless further information is taken into consideration:

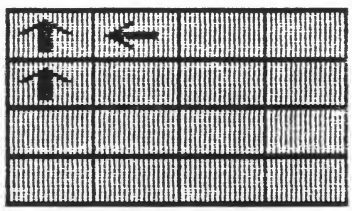


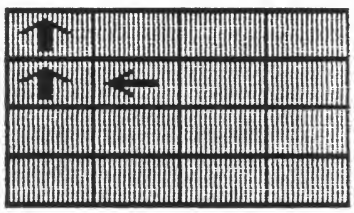


However, once the number of Blockers encountered by each Finder is taken into consideration, the ambiguity can be resolved. In the solution shown on the left above, Finder 1 encounters 3 Tilties. In the solution shown on the right, Finder 1 encounters 1 Tilty. This is the right solution, if the message indicated that Finder 1 encountered 1 Tilty, as shown below:

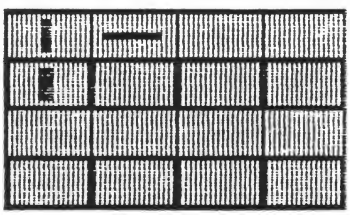


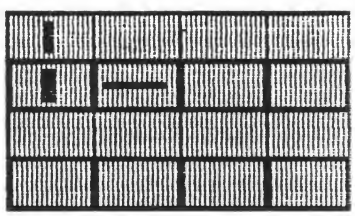
Similarly, even with as few as 3 Arrows or 3 Detours, several solutions are possible. If the number of Blockers encountered by each Finder is ignored, different solutions can be consistent with the destination of the Finders, as in this example:





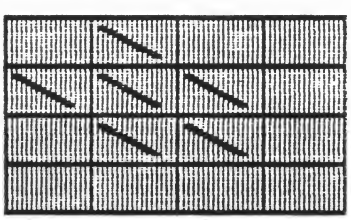
or this example:

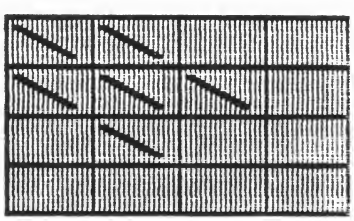




In the case above, knowing the number of Arrows or Detours encountered by each Finder reveals that only one solution is possible.

Some ambiguities cannot be solved, even though the number of Blockers is taken into consideration. This occurs especially at the Intermediate and Senior Levels. For example, the following layouts are similar with respect to the Finders' destinations and the number of Tilties they encounter. In such case, both solutions are acceptable:





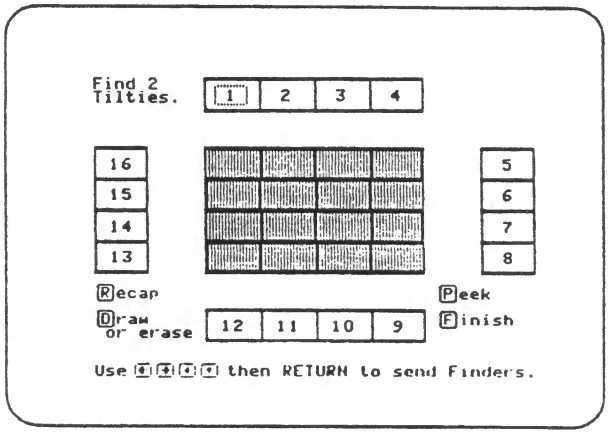
When there are several solutions possible, the students' solution is checked against the computer's solution. If their solution does not match the computer's solution, it is then checked for consistency with the Finders' destinations and the number of Blockers encountered. If the students' solution is correct but different from the computer version, the students are congratulated. They are also told how many of their Blockers match those of the computer (see Finish page 21 of this guide). Using the information provided in the scoring message (for example: 8 out of 9 Arrows matched those of the computer), students may then choose to continue their search and attempt to match the computer's solution.

SPECIAL OPTIONS

Once students think they have located a Blocker, they may choose to use the following options:

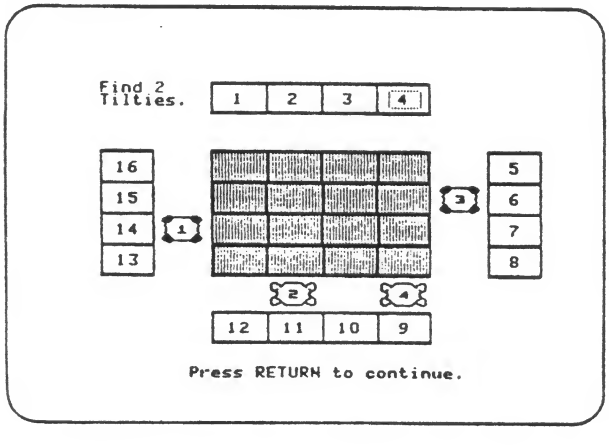
Recap
Draw / erase
Peek
Finish

These options are displayed at the bottom of the game screen, as shown below:



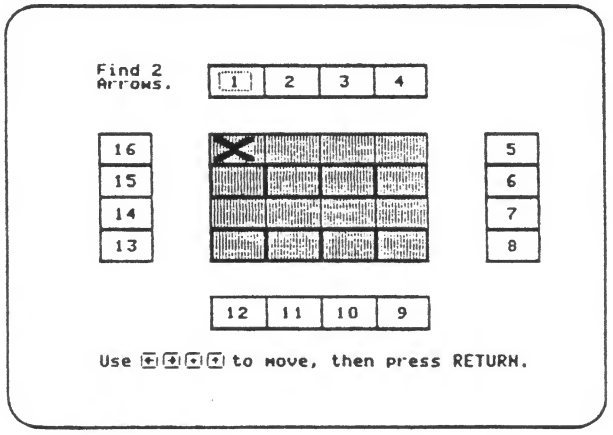
Recap

At any time during play, students can select R for Recap. A recap of the Finders' destinations is displayed, as shown below:

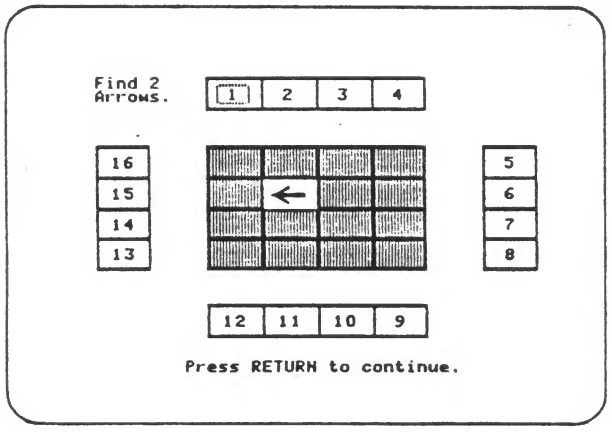


Peek

At any time during the game, students can select P for Peek. An X will then be displayed on the top left corner of the grid, as shown below:

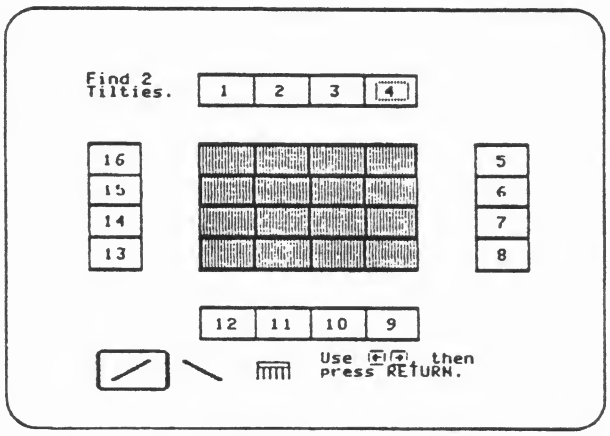


Students can then move the X horizontally or vertically to the grid box they wish to check. To do this, they use the arrow keys (on the Apple II+, they use the I, J, K, M keys). Pressing RETURN will uncover the selected grid box, revealing a Blocker or an empty box. In this case, the box reveals an Arrow, as shown below:

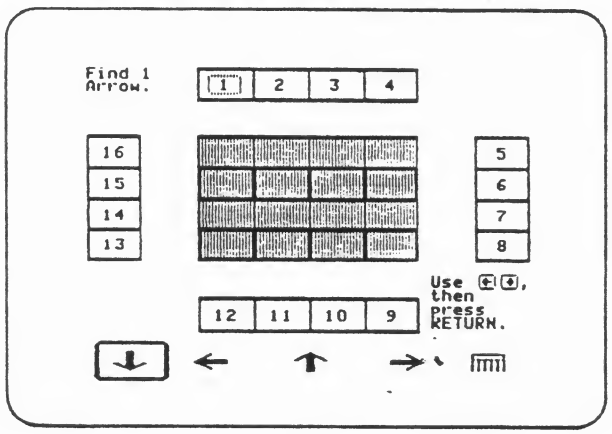


Draw-erase

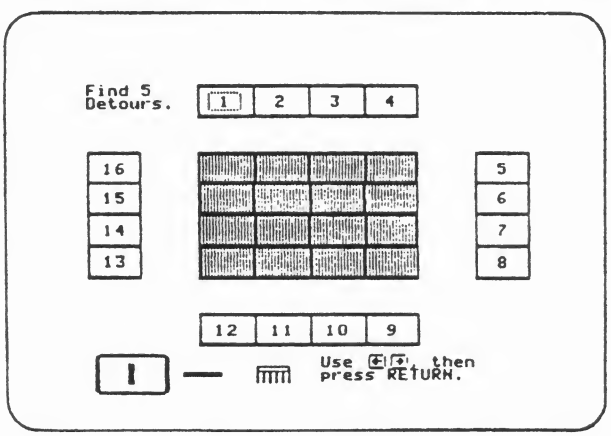
Students can choose to place a tentative Blocker on the board (or to erase one previously placed on the board) by selecting D . In a Tilty game, the choices are the Tilty, the Tilty, and the Scrub Brush ( ):



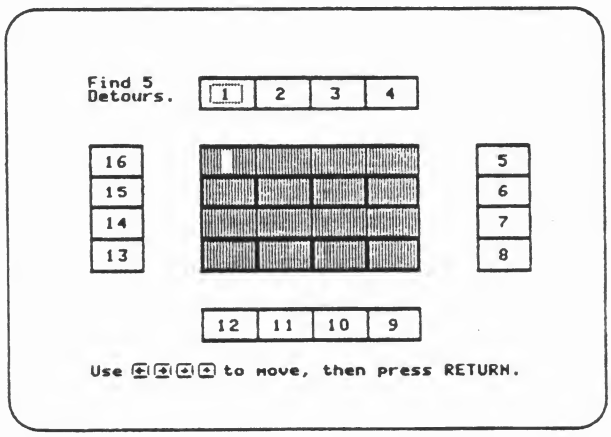
In an Arrow game, the choices are the 4 Arrows and the Scrub Brush:



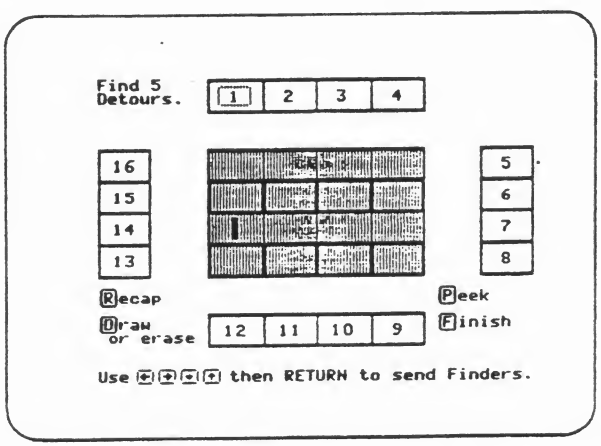
In a Detour game, the choices are the Detour, the Detour, and the Scrub Brush:



Students select the appropriate Blocker; it is then displayed on the top left corner of the grid, as shown below:



To move the tentative Blocker to the desired grid box, students use the arrow keys (on the Apple II+, they use the I, J, K, M keys), and then press RETURN. The Blocker will then remain as placed.



To erase a Blocker which they have drawn on the grid, students use the Scrub Brush ( ). Once it has been selected, the Scrub Brush is displayed in the top left corner of the grid. It can then be moved with the arrow keys over the Blocker to be erased (on the Apple II+, students use the I, J, K, M keys). Students can also erase a Blocker by drawing a new one over it. (For example, they may want to replace a Tilty with a one.)

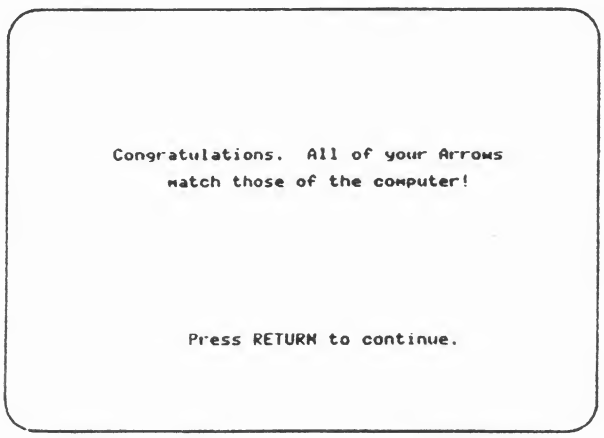
Note: Students may want to try their Blockers on the Grid Worksheet (page 37) before placing the Blockers on the computer grid.

Finish

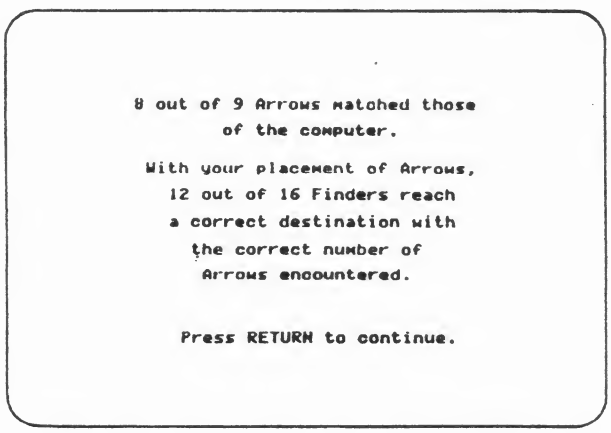
Students can select F for Finish. Their solution is then compared with the computer's solution. It wil fall into one of the 3 categories:

- **the students' solution matches the computer's solution.**
- **the students' solution is incorrect or partially correct.**
- **the students' solution is correct but different from the computer's solution.**

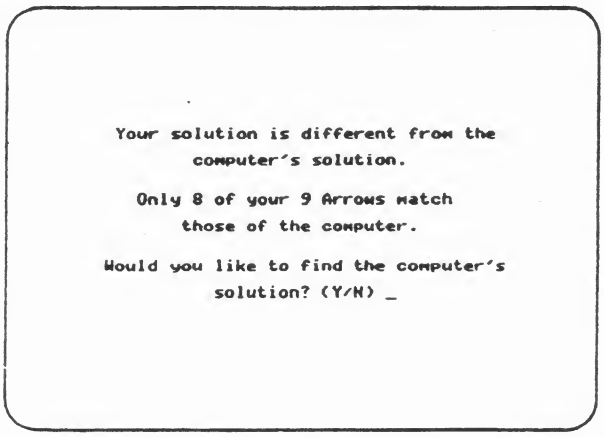
If the students' solution matches the computer solution, they are given a message such as the following:



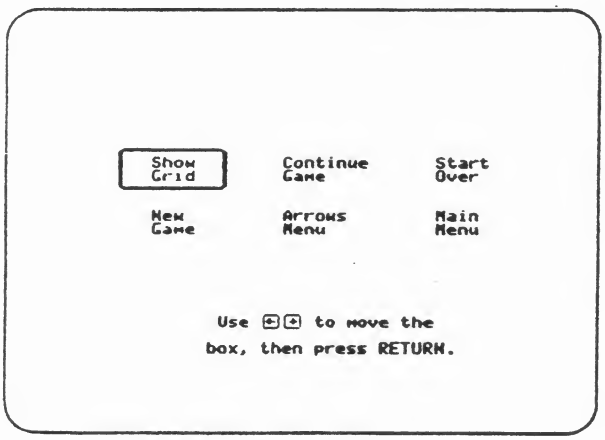
If their solution is not correct, they are given a message of this type:


8 out of 9 Arrows matched those
of the computer.
With your placement of Arrows,
12 out of 16 Finders reach
a correct destination with
the correct number of
Arrows encountered.
Press RETURN to continue.

If the students' solution is correct but different from the computer's version, students are congratulated as if their solution was correct (see page 21, top screen). They are then given a scoring message and the option to continue the search:


Your solution is different from the computer's solution.
Only 8 of your 9 Arrows match those of the computer.
Would you like to find the computer's solution? (Y/N) _

Answering "Yes" will bring the students back to the game. Answering "No" will bring them back to the menu shown below. This menu is also displayed for students whose solution matches the computer's solution, and for students whose solution is incorrect.



The following choices are then available:

- **Show Grid:** Allows students to see the computer solution. All the grid boxes are uncovered, and the hidden Blockers are displayed.
- **Continue Game:** Allows students to go back to their game at the exact place where they left off. Using the Draw/erase Option, students can then change the layout of their Blockers.

- **Start Over: Allows students to start the same game over. Students whose solution is totally inaccurate may want to start over rather than erase their Blockers one by one.**

- **New Game - Allows students to play a new game with the same number of Blockers. For example, students who were playing a nine-Arrow game will be given a different nine-Arrow game.**

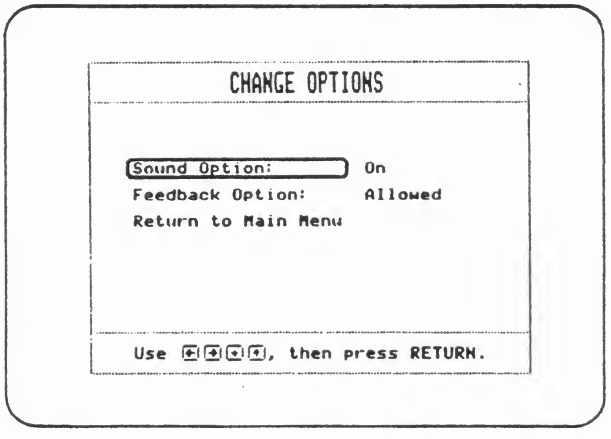
- **Tilties Menu / Arrows Menu / Detours Menu - Allows students to play a new game with a different number of Blockers. Students playing with Tilties are brought back to the Tilties Menu; students playing with Arrows are brought back to the Arrows Menu; students playing with Detours are brought back to the Detours Menu. They then choose the number of Blockers for their new game.**

- **Main menu - Allows students to go back to the Main Menu. They can then choose a different type of Blocker, or they may choose the End option to exit the game.**

***Note*: Students can exit the game at any time by holding down the CONTROL (CTRL) key and pressing the E key.**

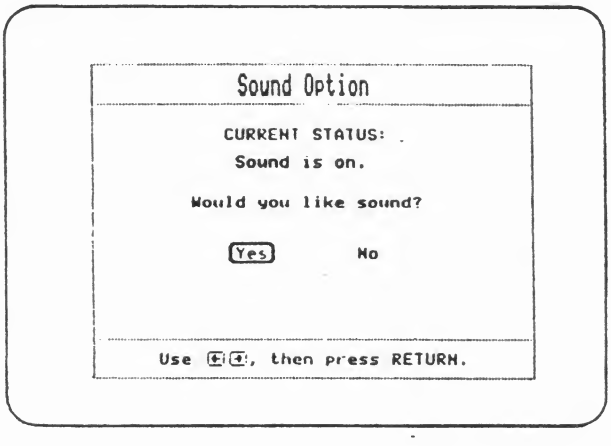
CHANGE OPTIONS

The Change Options allow the teacher to control certain elements of *BLOCKERS AND FINDERS* in order to adapt it to the needs of the students. To use the Change Options, the teacher holds down the CONTROL (CTRL) key and presses T at the main menu. The Change Options menu will then be displayed, as shown below:



SOUND OPTION

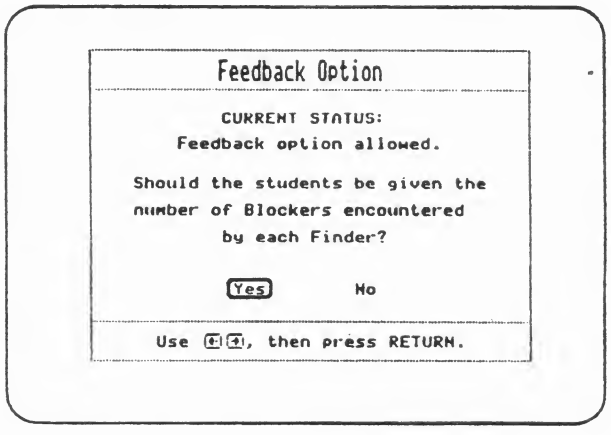
This option allows the teacher to choose whether the sound will be on or off during the program. Answering the question "Would you like sound?" will allow the teacher to turn the sound on or off. The sound will then remain in the mode selected until the Sound Option is used again.



FEEDBACK OPTION

This option allows the teacher to choose whether or not students will be given a Feedback message indicating the number of Blockers encountered by each Finder.

To use the Feedback Option, teachers select the option from the Change Options menu. The following screen will then be displayed:



Answering the question will allow the teacher to change the current status or to keep it as displayed. It will then remain in the mode selected until the Feedback Option is used again.

***Note*: Some teachers will find that the game is harder when the Feedback message is not allowed, as students have less clues to solve a problem. On the other hand, playing the game without the Feedback message will allow for more possible solutions, therefore making the game easier. With more and more play, teachers will find that the Feedback message makes it easier to find the computer's solution at the higher levels of play.**